A COMPARATIVE STUDY ON GROWTH OF CIRCUMFERENCE OF DIFFERENT BODY PART INFLUENCED BY THEIR LIVING ALTITUDES

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ABSTRACT:

PURPOSE: The purpose of the study was to find out the difference in circumference of different parts of body of 16 years old boys of four different altitudes of Darjeeling, West Bengal, India.

METHOD: The samples are school students. Researcher had taken 100 male students each from Sukhia Pokhari Higher Secondary School (Alt.-7200 ft.), Trunbull higher Secondary school (Alt.-6700 ft.), Jnanpith High school(Alt.-3000 ft.) and Kadamtala High School(Alt.-430 ft.). Researcher had measured height and weight as personal data measured circumference of head, neck, arm relax, flex arm, waist, gluteal, calf and ankle.

RESULTS: It has been observed that there were significant differences in neck, wrist and calf circumference.

CONCLUSIONS: Different growth pattern were observed among four different altitudes. This research paper also reveals the effect of altitude on growth pattern of adolescents.

Key words: body composition; circumference; altitude; male students.

I. INTRODUCTION

Body composition and growth are key components of health in both individuals and populations. The ongoing obesity found in case of children and adults has highlighted the importance of body fat for short term and long term health. Girths are circumference measures at standard anatomical sites around the body, measured with a tape measure. Girth measurements can be used in determining body size and composition, and to monitor changes in these parameters. The girth measurement gives an idea about our body fat deposits and precaution if needed can be taken.

Health is wealth so there is a simple test to determine the shape of person in and it has nothing to do with what we see in the mirror. Fat thighs and stuffed hips may have sighing in panic, but the real measure is the circumference of our waist. If it is below 80cm, it is fine. If it is between

80 and 88cm, then person is moving in the wrong direction and should take action. But if it is above 88cm, then person is in trouble. They have hit the red zone, real danger and need to seek professional help.

Though this study relate with growth pattern of difference body part circumference according to their living altitudes but this study also aims to explore the health status of the particular altitude adolescents. To understand the buildup about having a belly tyre, we need to know a little about abdominal fat and its dangers. There are two forms of fat. The first is subcutaneous fat, which sits immediately under the skin i.e, in the arms, thighs buttocks and abdomen. It is the kind of fat we are at war with when we try to get into those tight jeans. The second type is visceral fat, which sits inside, directly around the organs, and has a different anatomy to subcutaneous fat. In disease management, clinicians may worry about the amount of visceral fat we have around our organs because this is what makes us far more likely to suffer from serious chronic illnesses such as diabetes, hypertension and heart disease.

If a lot of fat is at our waist then we are at higher risk for such health problems as high blood pressure, high blood cholesterol and diabetes That increases our risk for heart disease and stroke. Obesity is now recognized as a major, independent risk factor for heart disease. Adolescents being the backbone of our society, it is very important to know about their health and recommend the exercise program accordingly.

II. METHODS

PURPOSE OF THE STUDY

The purpose of the study was to find out the difference in circumference of head, neck, arm relax, flex arm, waist, gluteal, calf and ankle of 16 years old school going male adolescents of four different altitudes of Darjeeling district.

THE SUBJECTS:

One hundred school going male students from four different altitudes were selected randomly as the subject of study. The altitudes were 430 feet, 3000 feet, 6700 feet and 7200 feet respectively. The age of the subjects was 16 years taken from school records.

CRITERION MEASURES:

Researcher had measured age, height and weight as personal data and measured the circumference of head, neck, arm relax, flex arm, waist, gluteal, calf and ankle.

III. RESULT AND DISCUSSION

Table-1: Mean and S.D of height and weight of four different altitudes

		Height				Weight			
Altitude	**N**	**Mean**	**SD**	**SEm (±)**	**CD (P=0.05)**	**Mean**	**SD**	**SEm (±)**	**CD (P=0.05)**
Age 16									
Sukhiapokhori HS School	25	1.68	0.057	**0.011**	**NS**	52.64	5.179	**1.053**	**NS**
Trunbull HS School	25	1.66	0.061	**0.011**	**NS**	51.52	5.124	**1.053**	**NS**
Jnanpith High School	25	1.64	0.046	**0.011**	**NS**	49.60	4.153	**1.053**	**NS**
Kadamtala High School	25	1.66	0.050	**0.011**	**NS**	52.64	6.363	**1.053**	**NS**

From the study, it was found that the mean height of Group-I (7200 ft.), Group-II (6700 ft.), Group-III (3000 ft.) and Group-IV (430 ft.) were 1.68 mt., 1.66 mt, 1.64 mt. and 1.66 mt. Similarly the mean weights were 52.64 kg., 51.52 kg., 49.60 kg. and 52.64 kg.

Table-2: Mean and S.D of circumference four different altitudes

		Head				Neck			
Altitude	**N**	**Mean**	**SD**	**SEm (±)**	**CD (P=0.05)**	**Mean**	**SD**	**SEm (±)**	**CD (P=0.05)**
Age 16									
Sukhiapokhori HS School	25	54.18	1.320	**0.295**	**0.827**	33.31	2.011	**0.349**	**NS**
Trunbull HS School	25	53.63	1.506	**0.295**	**0.827**	32.94	2.012	**0.349**	**NS**
Jnanpith High School	25	54.52	1.323	**0.295**	**0.827**	32.96	1.036	**0.349**	**NS**
Kadamtala High School	25	53.46	1.722	**0.295**	**0.827**	32.27	1.737	**0.349**	**NS**
		Arm relax				**Flex arm**			
Age 16									
Sukhiapokhori HS School	25	27.70	1.201	**0.346**	**0.970**	24.07	1.000	**0.247**	**NS**
Trunbull HS School	25	27.35	2.794	**0.346**	**0.970**	23.42	1.489	**0.247**	**NS**
Jnanpith High School	25	27.04	1.111	**0.346**	**0.970**	23.66	1.544	**0.247**	**NS**
Kadamtala High School	25	29.22	1.206	**0.346**	**0.970**	23.97	0.721	**0.247**	**NS**
		Forearm				**Wrist**			
Age 16									
Sukhiapokhori HS School	25	23.89	1.296	**0.343**	**0.962**	16.51	0.637	**0.119**	**0.334**
Trunbull HS School	25	24.58	2.493	**0.343**	**0.962**	16.34	0.616	**0.119**	**0.334**
Jnanpith High School	25	23.20	0.752	**0.343**	**0.962**	16.09	0.671	**0.119**	**0.334**
Kadamtala High School	25	23.44	1.817	**0.343**	**0.962**	15.64	0.436	**0.119**	**0.334**
		Waist				**Gluteal**			
Age 16									
Sukhiapokhori HS School	25	64.16	3.679	**1.438**	**NS**	83.37	4.209	**0.746**	**NS**
Trunbull HS School	25	62.95	12.254	**1.438**	**NS**	84.41	2.776	**0.746**	**NS**
Jnanpith High School	25	66.19	2.868	**1.438**	**NS**	82.24	1.676	**0.746**	**NS**
Kadamtala High School	25	66.16	5.899	**1.438**	**NS**	81.72	5.243	**0.746**	**NS**
		Calf				**Ankle**			
Age 16									
Sukhiapokhori HS School	25	33.06	4.899	**0.607**	**NS**	20.69	1.257	**0.298**	**NS**

Trunbull HS School	25	31.76	2.373	**0.607**	**NS**	21.22	1.933	**0.298**	**NS**
Jnanpith High School	25	31.44	1.058	**0.607**	**NS**	20.68	1.125	**0.298**	**NS**
Kadamtala High School	25	30.96	2.465	**0.607**	**NS**	20.29	1.512	**0.298**	**NS**

Table no-3: Analysis of variance of circumference

Source	Head					Neck				
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Altitude	17.878	3	5.959	2.731	.048	14.154	3	4.718	1.549	.207
Error	209.450	96	2.182			292.352	96	3.045		
Total	291233.630	100				108356.770	100			
Source	**Arm relax**					**Flex arm**				
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Altitude	27.735	3	9.245	3.675	.015	13.256	3	4.419	1.196	.315
Error	241.494	96	2.516			354.589	96	3.694		
Total	53616.37	100				69310.850	100			
Source	**Forearm**					**Wrist**				
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Altitude	27.681	3	9.227	3.137	.029	10.562	3	3.521	9.882	.000
Error	282.356	96	2.941			34.204	96	.356		
Total	56844.61	100				26107.640	100			
Source	**Waist**					**Gluteal**				
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Altitude	189.605	3	63.202	1.223	.306	108.398	3	36.133	2.594	.057
Error	4961.562	96	51.683			1337.352	96	13.931		
Total	425897.99	100				689283.76	100			
Source	**Calf**					**Ankle**				
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Altitude	11.247	3	3.749	1.082	.360	4.823	3	1.608	1.050	.374
Error	332.535	96	3.464			147.054	96	1.532		
Total	128679.68	100				66365.460	100			

Table-4: Least Significant Difference and Multiple Comparisons for circumference

		Head		Neck	
(I) Altitude	**(J) Altitude**	**Mean Difference (I-J)**	**Sig.**	**Mean Difference (I-J)**	**Sig.**
Sukhiapokhori HS School	Trunbull HS School	0.548	0.193	0.376	0.448
	Jnanpith High School	-0.340	0.418	0.348	0.482
	Kadamtala High School	0.716	0.090	1.040*	0.038
Trunbull HS School	Jnanpith High School	-0.888*	0.036	-0.028	0.955
	Kadamtala High School	0.168	0.688	0.664	0.182
Jnanpith High School	Kadamtala High School	1.056*	0.013	0.692	0.164
		Arm relax		**Flex arm**	
Sukhiapokhori HS School	Trunbull HS School	-0.100	0.831	0.216	0.692
	Jnanpith High School	1.230*	0.007	0.980	0.075
	Kadamtala High School	0.510	0.260	0.400	0.464
Trunbull HS School	Jnanpith High School	1.330*	0.004	0.764	0.163
	Kadamtala High School	0.600	0.181	0.184	0.736
Jnanpith High School	Kadamtala High School	-0.720	0.110	-0.580	0.289
		Forearm		**Wrist**	
Sukhiapokhori HS School	Trunbull HS School	-0.688	0.159	0.172	0.311
	Jnanpith High School	0.692	0.157	0.420*	0.015
	Kadamtala High School	0.456	0.350	0.864*	0.000
Trunbull HS School	Jnanpith High School	1.380*	0.005	0.248	0.145
	Kadamtala High School	1.144*	0.020	0.692*	0.000
Jnanpith High School	Kadamtala High School	-0.236	0.628	0.444*	0.010
		Waist		**Gluteal**	
Sukhiapokhori HS School	Trunbull HS School	1.21	0.554	-1.040	0.327
	Jnanpith High School	-2.03	0.320	1.128	0.288
	Kadamtala High School	-2.00	0.329	1.656	0.120

Trunbull HS School	Jnanpith High School	-3.24	0.114	2.168*	0.043
	Kadamtala High School	-3.20	0.118	2.696*	0.012
Jnanpith High School	Kadamtala High School	0.04	0.986	0.528	0.618
		Calf		**Ankle**	
Sukhiapokhori HS School	Trunbull HS School	1.296	0.134	-0.524	0.216
	Jnanpith High School	1.620	0.062	0.016	0.970
	Kadamtala High School	2.092*	0.017	0.400	0.345
Trunbull HS School	Jnanpith High School	0.324	0.707	0.540	0.203
	Kadamtala High School	0.796	0.356	0.924*	0.031
Jnanpith High School	Kadamtala High School	0.472	0.584	0.384	0.364

From the study (table no.2), the mean circumference of head of group-c (3000) was found to be highest with mean of 54.52cm. with variation of 1.323. So, growth of head is more at an altitude of 3000 mt.

It was found from the study of M.E. Zaki, N.E. Hassan and S.A. El-Masry (2008), the average head circumference of 16 year old Egyptian adolescents was was 54.76 cm. with S.D of 1.62 [1].

Similarly, the mean value of neck circumference of Group-A was 33.31cm. which was largest among the group with standard deviation of 2.011 For neck circumference of age group 16, groups may be arranged in descending order as Group-A>Group-C>Group-B>Group-D.

It was found that the mean circumference of arm of Group- B (6700 ft.) was highest with mean value of 23.60 cm. with variation of 1.440. For Arm circumference of age group 16, groups may be arranged in descending order as Group-B>Group-A>Group-D>Group-C.

It was found from the study of C.D.Fryar, Q.Gu and C.L Ogden (2012), the average arm circumference of 16 year old adolescents of United States was 30.6 cm [2]. With SEM of 0.41, for Chhattisgarh J. N. Vidyalaya adolescents it was 23.76cm.with S.D of 2.13 and for Chhattisgarh K. V. students it was 24.29cm. With S.D of 5.37(M. Shukla, R. Venugopal and M. Mitra-2008), for Shabar Tribal Adolescents of Orissa it was 22.2 cm [3]. with S.D of 2 (Chakrabarty and Premananda Bharati -2008) and for Bengali Boys of Nimta, West Bengal it was 22.8 cm [4]. with

S.D of 3.1(A. Mukhopadhyay, M. Bhadra and K. Bose-2005) and for male students of 24 Pgs (N), West Bengal, it was 22.23cm. with S.D of 1.74 [5]. Analysing the result of arm circumfertence it may be concluded that the present study has close proximity to (M. Shukla, Venugopal and M. Mitra (2008) and A. Mukhopadhyay, M. Bhadra and Kaushik Bose-2005) [3-5]. Similarly, the mean value of flex arm circumference of Group-A was 26.66 cm. which was highest among the group with standard deviation of 1.904. For Flex arm circumference of age group 16, groups may be arranged in descending order as Group-A>Group-B>Group-D>Group-C.

From table, it was found that the mean forearm circumference of Group-B (6700 ft.) was 24.58cm. which was highest in the groups with variation of 2.493. For Forearm circumference of age group 16, groups may be arranged in descending order as Group-B>Group-A>Group-D>Group-C.

The mean value of wrist circumference of Group-A was 16.51cm. which was highest among the group with standard deviation of .637. For Wrist circumference of age group 16, groups may be arranged in descending order as Group-A>Group-B>Group-C>Group-D.

From study, it was found that in the age group of 16, the mean circumference of waist the mean value of Group-C (3000 ft.) was first among the group and the mean value was 66.19cm. with variation of 2.868. For Waist circumference of age group 16, groups may be arranged in descending order as Group-C>Group-D>Group-A>Group-B.

It was found from the study of C.D.Fryar, Q.Gu and C.L Ogden (2012) that the average waist circumference of 16 year old adolescents of united states was 83.9 cm. with SEM of 1.21, for Shabar Tribal Adolescents of Orissa it was 64 cm. with S.D of 3.2 (Chakrabarty and Bharati - 2008) and for Bengali Boys of Nimta, North 24 Parganas, West Bengal it was 64.4 cm. with S.D of 6.4 (A. Mukhopadhyay, Bhadra, 2005) [2-4-5]. Analysing the result of waist circumference it may be concluded that the present study has close proximity to [4-5].

The mean value of gluteal circumference of Group-B was 84.41 cm. which ranks first in the group with variation of 2.776. Though there was no significant critical difference in gluteal circumference among the 16years boys of four different altitudes, analysis of variance was conducted in table-14B where "F" value (2.594) found shows no significant difference. For

Gluteal circumference of age group 16, groups may be arranged in descending order as Group-B>Group-A>Group-C>Group-D.

It was found from the study of (S. Chakrabarty and Bharati 2008) that the average gluteal (hip) circumference of 16 year old Shabar Tribal Adolescents of Orissa was 76 cm. with S.D of 4.3 and for Bengali Boys of Nimta, North 24 Parganas, West Bengal it was 78.8 cm. with S.D of 6.8 (A. Mukhopadhyay - 2005) [4-5].

The mean circumference of calf of Group-A (7200 ft.) was 33.06cm. which was highest among the groups with standard deviation of 4.899. For Calf circumference of age group 16, groups may be arranged in descending order as Group-A>Group-B>Group-C>Group-D.

It was found from the study of Margaret A. McDowell, C. D. Fryar, C. L. Ogden and Katherine M. Flegal (2008), the average calf circumference of 16 year old adolescents of united states was 38.2 cm. with SEM of 0.37, for Chhattisgarh J. N. Vidyalaya adolescents it was 32.57 cm. with S.D of 2.54 and for Chhattisgarh K. V. students it was 33.01 cm. with S.D of 6.78 (M. Shukla, R. Venugopal and M. Mitra-2008), for Shabar Tribal Adolescents of Orissa it was 29.7cm.with S.D of 2.7(S. Chakrabarty and P. Bharati -2008) and for Bengali Boys of Nimta, West Bengal it was 29.9 cm.with S.D of 3 (A. Mukhopadhyay, M. Bhadra and K. Bose-2005). Analysing the result of calf circumference it may be concluded that the present study has close proximity to M. Shukla, R. Venugopal and M. Mitra (2008). [6-3-4-5-3].

The mean value of ankle circumference of Group-B was 21.22 cm. which ranks first in the group with variation of 1.933. For Ankle circumference of age group 16, groups may be arranged in descending order as Group-B>Group-A>Group-C>Group-D.

IV. CONCLUSION

From above findings following conclusions can be drawn;

- Group-A (Altitude-7200 ft.) male students had greater growth rate in neck, arm relax, flex arm, wrist and calf circumference among four different altitudes. It also indicates that the growth of the said circumference increase with increase in altitudes.
- Group-B (Altitude-6700 ft.) male students had greater growth rate in forearm, gluteal and ankle circumference among four different altitudes.
- Group-C (Altitude-3000 ft.) male student had greater growth rate of head and waist circumference.

V. RECOMMENDATION

- Similar type of study can be done for different age groups.
- Similar type of study can be done on other anthropometric measurements.
- Similar type of study can be done on different altitude.

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